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brightest, and, excepting it, they are all straight. It divides at about 1° from the nucleus and near the point of division it is strongly curved. The central part of the tail is about 1° wide at 6° from the nucleus.

Sunday, July 16. The comet presents essentially the same appearance as last night. The central part of the tail broadens a little more rapidly. The streamers are numerous.

Tuesday, July 18, 9^h 01^m to 10^h 21^m. In contrast with all the previous negatives, the tail is single near the nucleus. It is very slender at its departure from the coma, and, for about 1° , broadens slowly. Then it begins to divide with numerous streamers. Lateral streamers on the southern side of the tail are common, but not long. The principal streamers are not equally dense in all their parts. Here again is a doubtful suggestion of outward spiral action.

PALO ALTO, CAL., July 22, 1893.

THE SPECTRUM OF COMET *b*, 1893.

BY W. W. CAMPBELL.

The spectrum of this comet has been observed here both visually and photographically, and a large number of new bright lines have been detected.

VISUAL OBSERVATIONS.

The yellow, green and blue bands appear with their usual intensities, but their less refrangible edges seem to be completely resolvable into bright lines. Wave-lengths were determined for two lines in the yellow band, three in the green and one in the blue; and several other ill-defined lines were seen in the yellow and blue bands. A red band at *w. l.* 601 and violet bands at *w. l.* 434 and *w. l.* 421 are easily visible. The wave-lengths obtained are given in the following table. The fifth column contains KAYSER and RUNGE's wave-lengths of the edges of the corresponding carbon bands.

The continuous spectrum of this comet is relatively much

fainter than I have observed in any comet of the past two years, though easily visible from about 6300 to 4100.

July 11.	July 12.	July 17.	July 25.	Carbon Bands.	Description of Bright Lines and Bands.
600	601	.....	.....	619-595	Maximum of red band, broad, faint.
562	.....	.....	.....	5635	Red edge of yellow band.
.....	.....	5633	.....	5585	Very faint line, terminating yellow band.
.....	.....	558	.....	5165 3	Bright line in yellow band.
5162.1	5161.8	5163.9	5163.6	5129	Very bright line terminating green band.
5124	5127	5128	.....	4737	Very bright line in green band.
.....	.....	509	.....	4737	Very bright line in green band.
4734	.....	4734	.....	.....	Red edge of blue band.
.....	434	.....	.....	.....	Bright line terminating blue band.
.....	421	.....	.....	.....	Bright region in continuous spectrum, faint.
.....	.....	.....	.....	.....	Bright region in continuous spectrum, faint.

PHOTOGRAPHIC OBSERVATIONS.

Two photographs of the region *w. l.* 487-387 were obtained. They show five lines in the less refrangible side of the blue band. The rest of this band does not resolve into bright lines, but diminishes gradually in brightness in both directions from the maximum near 4680, extending from about 4730 to 4610.

The two violet bands observed visually at *w. l.* 434 and 421 are shown to consist of five and two lines respectively. The results for these plates are given below; and likewise, in the last column, the wave-lengths of the corresponding bands and lines of carbon and cyanogen as given by KAYSER and RUNGE.

July 13.	July 16.	CARBON.	Description of Bright Lines.
4736.1	4736.3	4737.2	Very bright line, the head of blue band group.
4716.7	4715.2	3715.3	Very bright line in the blue band group.
4698.1	4696.0	4697.6	Very bright line in the blue band group.
4683.4	4683.0	4684.9	Brightest line in the blue band group.
4674.8	4675.4	.....	Apparently a very bright line, in the blue band group, but not well separated from 4683.
4366.3	4366.1	(4365.0?)	Very bright line.
4350.3	4349	.....	Very faint line.
4333.9	4335.8	.....	Faint line.
4313.2	4312.7	.....	Very bright line.
4298.7	4298.0	.....	Very bright line.
4253	426	.....	Very faint line.
4235	4234	.....	Very faint line.
CYANOGEN.			
4214.3	4214.2	4216.1	Very bright line.
4196.7	4195.8	4197.2	Bright lines.
4178	.....	4180.7	Very faint line, uncertain.
4126	.....	4128.1	Faint line.
4098.0	4097.8	4099.2	Bright line.
4071.8	4073.5	4073.7	Bright line, probably double, at 4075 and 4069.
4052.4	4052.2	4053.3	Bright line.
4043.9	4042.3	.....	Bright line.
4017.1	4021.4	.....	Bright line.
4011.2	.....	.....	Faint line.
3988	3988	.....	Very faint line.
3881.2	3881.3	3883.5	Very bright line, probably the brightest in spectrum.
3870.0	3869.9	3871.5	Bright line, broad, resembles a band, more refrangible edge faint.

The agreement of the comet spectrum with the strong bands and lines in the carbon and cyanogen spectra is perfect, within the limits of error, except that the wave-lengths for the comet are systematically less by one or two tenth-metres than KAYSER and RUNGE'S results. At first I was inclined to attribute the discordance to the large flexure of the spectroscope when the great telescope is in nearly a horizontal position. But the same discordance exists also in the visual observations, which are not affected by flexure. An explanation may possibly be found in the fact that in the various spectra we have to deal with unsymmetrical bands, to some extent, rather than with lines.

The photographs of KAYSER and RUNGE do not include the carbon line at 4675; but it has been observed by HASSELBERG and by WATTS; and the photographs of the spectra of Bunsen flames and of cyanogen flames made by H. W. VOGEL show the five lines in the blue band and the unresolved part of the band exactly as observed by me in the comet spectrum. KAYSER and RUNGE'S work does not cover the region 4366-4234; but VOGEL'S photographs of the cyanogen spectrum contains lines which probably are identical with the comet lines at 4366 and 4313, and possibly with a few others.

All the observations were made with a dense 60° prism.

The 36-inch telescope presents several positive disadvantages for comet spectrum work, of which I may mention two.

The ratio of focal length to aperture, 19:1, is much larger than exists in small telescopes, and hence the latter would form much brighter images on the slit-plate than the former.

The guiding in photographic work with the long telescope is difficult with low and rapidly moving objects.

COMPARISON OF THE NEW STAR SPECTRUM
WITH THE SPECTRA OF FIVE WELL-
KNOWN NEBULÆ.

BY W. W. CAMPBELL.

The earliest observations of the August, 1892, spectrum of *Nova Aurigæ* convinced me that it was nebular. There was not the slightest resemblance to any other known type. The continuous spectrum was extremely faint, as in the case of the